3.14 Energy

3.14.1 Regulatory Setting

The National Environmental Policy Act (NEPA) (42 United States Code [USC] Part 4332) requires the identification of all potentially significant impacts to the environment, including energy impacts.

The California Environmental Quality Act (CEQA) Guidelines, Appendix F, Energy Conservation, state that EIRs are required to include a discussion of the potential energy impacts of proposed projects, with particular emphasis on avoiding or reducing inefficient, wasteful and unnecessary consumption of energy.

3.14.2 Affected Environment

3.14.2.1 Energy Resources and Consumption

The information in this section is from the United States Energy Information Administration Profile Analysis, June 2014.[1]

With the largest economy in the nation, California runs on energy. It is the most populous state and its total energy demand is second only to Texas. California State policy promotes energy efficiency. The State's extensive efforts to increase energy efficiency and the implementation of alternative technologies have restrained energy demand growth. Although it is a leader in the energy-intensive petroleum, chemical, forest product, and food product industries, California has one of the lowest per capita total energy consumption levels in the country.

Transportation dominates California's energy consumption profile. Major airports, military bases, and California's many motorists all contribute to high demand. More motor vehicles are registered in California than in any other state, and commute times in California are among the longest in the country. California leads the nation in registered alternatively fueled vehicles and requires that all California motorists use, at a minimum, a specific blend of gasoline called California Reformulated Gasoline (CaRFG). In ozone non-attainment areas, motorists face even stricter requirements and must use California Oxygenated Reformulated Gasoline. As a result, California also leads the nation in retail sales of reformulated gasoline products.

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1 Energy Information Administration. 2015. Website: http://www.eia.gov/state/analysis.cfm?sid=CA (accessed July 29, 2015).

In much of the more densely populated areas of the State, the climate is dry and relatively mild. More than two-fifths of households in California report that they do not have or do not use their air-conditioning, and residential energy use per person in the State is among the lowest in the nation.

California is also rich in energy resources. The State has an abundant supply of crude oil and is a top producer of conventional hydroelectric power. California also has extensively developed solar, wind, biomass, and geothermal resources that produce substantial amounts of energy.

Petroleum

California is oil rich. Even though California's crude oil production has declined overall in the past 25 years, it is one of the top producers of crude oil in the nation, accounting for more than 7 percent of total production in the United States. Petroleum reservoirs in the geologic basins along the Pacific Coast and in the Central Valley contain large crude oil reserves. The most prolific oil-producing area is the San Joaquin basin in the southern half of the Central Valley.

Federal assessments of California's offshore areas indicate the potential for large undiscovered reserves of recoverable crude oil and natural gas in the federally administered Outer Continental Shelf (OCS), possibly as much as 10 billion barrels of crude oil and 16 trillion cubic feet of natural gas. A federal moratorium on oil and gas leasing in OCS waters expired in 2008. However, no new lease sales for exploration in California federal offshore waters are currently scheduled. In California, concerns regarding the cumulative impacts and risks of offshore oil and gas development led to a permanent State moratorium on offshore oil and gas leasing in State waters after 1969. Development of State leases acquired prior to 1969 is not affected by this moratorium.

California ranks third in the nation in petroleum refining capacity and accounts for more than one-tenth of the total capacity in the United States. However, California is a net importer of oil. It produces only about 37 percent of the petroleum it uses.[1] A network of crude oil pipelines connects the State's oil production to refining centers in the Central Valley, Los Angeles, and the San Francisco Bay area. California refiners also process large volumes of Alaskan and foreign crude oil received at ports in Los Angeles, Long Beach, and the Bay Area. Crude oil production in California

[1] California Petroleum Statistics and Data. 2015, Website: http://energyalmanac.ca.gov/petroleum/ (accessed August 2015).

and Alaska has declined, and California refineries have become increasingly dependent on foreign imports to meet the State's needs. Led by Saudi Arabia, Ecuador, Iraq, and Colombia, foreign suppliers now provide more than half of the crude oil refined in California.

California's largest refineries are highly sophisticated and are capable of processing a wide variety of crude oil types. To meet strict federal and State environmental regulations, California refineries are configured to produce cleaner fuels, including reformulated gasoline and low-sulfur diesel. California refineries often operate at or near maximum capacity because of the high demand for those petroleum products. The relative isolation and specific requirements of the California fuel market make California motorists particularly vulnerable to short-term spikes in the price of motor gasoline. When unplanned refinery outages occur, replacement supplies must be brought in by marine tanker. Locating and transporting replacement motor gasoline that conforms to the State's strict fuel specifications can take 2 to 6 weeks.

Natural Gas

As with crude oil production, California's natural gas gross production has experienced a gradual overall decline in the past 2 decades. The natural gas reserves and production are primarily in geologic basins in the Central Valley, the coastal basins onshore in northern California, and offshore along the southern California coast. California production accounts for a very small percentage of total natural gas production in the United States and meets about one-tenth of State demand.

Interstate pipelines bring natural gas from Arizona, Nevada, and Oregon to California where markets are served by two key natural gas trading centers, the Golden Gate Center in northern California and the California Energy Hub in southern California. As of July 2011, new supply has arrived by way of the Ruby pipeline that extends from Wyoming to Oregon, linking Wyoming natural gas supplies to markets in northern California. The State also has more than a dozen natural gas storage fields that help stabilize supply. Together, those storage fields have a storage capacity of more than 500 billion cubic feet of natural gas and a working gas capacity of approximately 300 billion cubic feet. California has long exported natural gas to Mexico, but since 2008 has also imported natural gas from Mexico. In May 2008, operations began at Mexico's liquefied natural gas import terminal in Baja, Mexico. Although Baja California in Mexico is the primary market for the terminal's natural gas supply, natural gas not consumed in Mexico will be exported to the southwestern

United States, including California, until demand in Mexico reaches the terminal's full capacity.

Coal

California has no coal production and has been phasing out its use of electricity generated by coal-fired power plants. In addition to minor amounts of coal currently consumed at plants in the electric power sector, some coal is also consumed at industrial facilities. Almost all of the coal consumed in California is from mines in Utah and Colorado. Some coal also arrives by rail from western coal mines and is exported to overseas markets from port facilities located primarily in the Los Angeles and San Francisco areas.

Electricity

Because California consumes much more electricity than it generates, about one-fourth of California's electricity comes from out of State. Overall, the State receives more electricity from outside its borders than any other state in the nation. States in the Pacific Northwest deliver power to California markets that is generated at hydroelectric power plants, and states in the southwest have, in the past, delivered power primarily generated at coal-fired power plants. Electricity supplied from coal-fired power plants has decreased since the enactment of a State law in 2006 that requires California utilities to limit new long-term financial investments in base-load generation to those power plants that meet strict California emissions performance standards.

In-state natural gas-fired power plants account for more than half of the electricity generation in California. Until 2012, California's two nuclear power plants with their four reactors typically provided almost one-fifth of the State's total generation. However, the two reactors at the San Onofre Nuclear Generating Station (SONGS) were permanently shut down in 2013 cutting the amount of electricity generation in California from nuclear power in half. With adequate snowpack, hydroelectric power typically accounts for between one-tenth and one-fourth of California's total net generation of electricity. In the past decade alone, hydroelectric power has averaged one-sixth of the State's net generation of electricity. By contrast, only a small amount of the electricity generated in California comes from coal-fired sources.

In 2000 and 2001, California suffered an energy crisis caused by a supply and demand imbalance characterized by electricity price instability and blackouts. Many factors contributed to this imbalance, including the State's dependence on out-of-state electricity providers, a lack of generation capacity, drought, market manipulation, a pipeline rupture, increased competition with other western states for supply, and unusually high temperatures. Following the crisis, the California State government developed an Energy Action Plan that was designed to eliminate outages and excessive price spikes. Its goal was to ensure that adequate, reliable, and reasonably priced electrical power and natural gas supplies, including prudent reserves, were provided. To achieve its goals, the Plan called for optimizing energy conservation, building new generation facilities, and upgrading and expanding the electricity transmission and distribution infrastructure to ensure that generation facilities could quickly come online when needed. California imports substantial amounts of electricity from neighboring systems, making transmission capability a critical reliability concern. For example, the Sunrise Powerlink Transmission project, which was put into service in June 2012, added approximately 800 megawatts (MW) of transmission capability to the southern California electricity grid. Those new transmission lines bring electricity generated from renewable energy from Imperial County, in the southeastern corner of the State, to San Diego.

Renewable Energy

California is among the top states in the nation, typically second after Washington, in net electricity generation from renewable resources. A top producer of electricity from conventional hydroelectric power, California is also a leader in net electricity generation from other renewable energy sources, including geothermal, solar, wind, and biomass. There are substantial geothermal resources in the coastal mountain ranges and in volcanic areas in northern California, as well as along the State's borders with Nevada and Mexico. There are wind resources along the State's many eastern and southern mountain ranges and there is high solar energy potential in the southeastern California deserts. The California Renewable Portfolio Standard sets a goal of 33 percent of electricity generation from eligible renewable resources by 2020. Eligible resources include wind, solar, geothermal, biomass, biogas, and small hydroelectric generation facilities (less than 30 MW).

With over 2,700 MW of installed capacity, California is the top producer of electricity from geothermal energy in the nation. The facility known as The Geysers, in the Mayacamas Mountains north of San Francisco, is the largest complex of geothermal power plants in the world, with more than 700 MW of installed capacity. Although wind power potential is widespread, almost three-fourths of the land in the State is excluded from development of this type of energy generation because the land consists of wilderness area, parks, urban areas, or bodies of water. Nonetheless, the State is a top generator of electricity from wind energy, producing almost 8 percent of the nation's total, ranking third behind Texas and Iowa. California also leads the nation in the generation of electricity from biomass and solar energy. The world's largest solar thermal plant, in California's Mojave Desert, began delivering electricity to the grid in early 2014. On a smaller scale, the California Solar Initiative offers cash back for installing solar power systems on rooftops of homes and businesses.

Growing concern over the environment has spurred policy initiatives to reduce greenhouse gas (GHG) emissions. California's Low Carbon Fuel Standard, issued in January 2007, called for a reduction of at least 10 percent in the carbon intensity of California's transportation fuels by 2020. That standard requires substitutes for fossil fuels that demonstrate lower lifecycle GHG emissions than the fuels they replace. A reduction in the carbon intensity of transportation fuels was first required in 2011. A number of alternative pathways have been identified that reduce the levels of GHG emissions in the production of ethanol, biodiesel, and renewable diesel. California has several ethanol production plants in State, but most of its ethanol supply arrives by rail from the Midwest.

California has also established an emissions cap-and-trade program as part of the State's Global Warming Solutions Act of 2006. The goal of that program is to reduce the State's GHG emissions to their 1990 levels by 2020. Major sources of GHG emissions in the State, including refineries, power plants, industrial facilities, and transportation fuels, must meet a GHG emissions gas cap that declines over time. To minimize the costs of pollution controls, a system for trading allowable emissions permits was created. The California Air Resources Board (ARB) held its first auction of the tradable GHG emissions permits for the cap-and-trade program in November 2012. California also has adopted policies to promote increased energy efficiency, including introducing stricter appliance efficiency standards and setting higher standards for public buildings. The State also requires net metering and power source disclosure from utilities.

3.14.2.2 Energy Consumption in California and Orange County[1]

Unless otherwise noted, the following information and statistics are from the California Energy Commission (CEC) Energy Almanac.[1] Statistics are the most recent available as of July 2015.

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1 Energy consumption for the County of Riverside is not discussed in this section because the only project improvements in the County of Riverside consist of advance signage.

Electricity

Fueled by population growth, the demand for electricity in California is increasing. At the same time, the State is mandating a decrease in GHG emissions. In 2013, California's electricity mix was generated by natural gas (approximately 44.3 percent), coal (approximately 7.8 percent), large hydroelectric (approximately 7.8 percent), nuclear (approximately 8.8 percent), and renewable (approximately 19 percent) sources. In 2013, California produced approximately 67 percent of the electricity it used; the rest was imported from the Pacific Northwest (approximately 12 percent) and the southwestern United States (approximately 21 percent). Under the Renewables Portfolio Standard, California's goal was to increase the amount of electricity generated from renewable energy resources to 20 percent by 2010. Legislation passed in 2011 pushed that goal to 33 percent by 2020. Currently, California's in-State renewable generation consists of biomass, geothermal, small hydroelectric, wind, and solar generation sites that made up approximately 17 percent of the total in-State generational output.[2]

The electrical use in Orange County in 2013 is shown in Table 3.14.1.

Table 3.14.1 Annual Electric Consumption in Orange County in 2013

Type of Consumer	Millions of kWh
Orange County	
Residential	6,301
Nonresidential	13,721
Total	**20,022**

Source: *California Energy Commission* (2013). Energy Consumption Data Management System (October 2013). Website: http://www.ecdms.energy.ca.gov/elecbycounty.aspx.
kWh = kilowatt-hours. A unit of power equal to 1,000 watts of electricity consumed in an hour.

1 California Energy Commission, California Energy Almanac. 2015. Website: http://www.energyalmanac.ca.gov/index.html (accessed July 30 and August 4, 2015).

2 California Energy Commission. 2015. Website: http://www.energy.ca.gov/renewables/tracking_progress/documents/renewable.pdf (accessed July 29, 2015).

Natural Gas Consumption

Demand for natural gas falls mainly into four sectors: residential, commercial, industrial, and electric power generation. Very small amounts are also used for vehicle fuel, and for production and transmitting natural gas to consumers.

Approximately 90 percent of the natural gas California used was imported from other states. Dispatchable natural gas-fired generation is the dominant source of electricity in California, accounting for 43 percent of all generation in California in 2012. The majority of natural gas is distributed by the State's three major natural gas utility companies (San Diego Gas and Electric, Southern California Gas Company, and Pacific Gas and Electric). Natural gas is the most widely used energy source in California. The use of natural gas in Orange County in 2013 is shown in Table 3.14.2.

Table 3.14.2 Natural Gas Consumption in Orange County in 2013

Land Use	Millions of Therms
Orange County	
Residential	398
Non-residential	243
Total	**641**

Source: California Energy Commission. Energy Consumption Data Management System. 2013. Website: http://www.ecdms.energy.ca.gov/ (October 2013).
therm = a unit of heat containing 100,000 British thermal units (BTUs).

Nuclear Energy

In 2010, nuclear provided almost 14 percent of the entire California power mix (including out-of-State imports). As of mid-2012, California had one operating nuclear power plant: Diablo Canyon (2,160 MW), near San Luis Obispo. That plant's nuclear units use ocean water for cooling.

The 2,150 MW SONGS, about midway between Los Angeles and San Diego, went offline in January 2012 and was ordered by the Nuclear Regulatory Commission to stay offline while tubing wear issues were investigated. The plant owners announced in June 2013 that remaining Units 2 and 3 would be permanently retired.

Petroleum

California is a net importer of oil. It produces only about 37.2 percent of the petroleum it uses. In 2007, the State spent nearly $50 billion for gasoline and $9.7 billion for diesel.

Petroleum-based fuels account for 96 percent of the State's transportation needs which makes Californians vulnerable to petroleum price spikes.

The State is now developing flexible strategies to reduce petroleum use. In the meantime, the demand for gasoline and diesel fuel will continue to rise because of population growth, the lack of mass transit, and the number of sports utility vehicles on California's roads. Also, jobs and housing continue to be further apart, increasing the miles traveled by the work force.

Renewable Energy

California with its abundant natural resources has had a long history of support for renewable energy. In 2009, 11.6 percent of all electricity came from renewable resources such as wind, solar, geothermal, biomass, and small hydroelectric facilities. Large hydroelectric plants generated another 9.2 percent of California's energy.

Liquid Petroleum Gas/Propane

Liquefied petroleum gas (LPG), usually referred to as propane, is a mixture of gaseous hydrocarbons (mainly propane and butane) that change into liquid form under moderate pressure. Propane is commonly used as a fuel for rural homes for space and water heating, as a fuel for barbecues and recreational vehicles, and as a transportation fuel. It is normally created as a byproduct of petroleum refining and from natural gas production.

Propane has been used as a transportation fuel since 1912 and is the third most commonly used fuel in the United States, behind gasoline and diesel. More than four million vehicles fueled by propane are in use around the world in light-, medium-, and heavy-duty applications. Propane holds approximately 86 percent of the energy of gasoline and so requires more storage volume to drive a range equivalent to gasoline, but it is generally price-competitive on a cents-per-mile-driven basis.

Propane is generally an unregulated fuel in California (except for storage and safety issues, which are regulated). Because it is an unregulated commodity, the State does not collect data on propane sales or usage. The statistics for propane in Alternatives to Traditional Transportation Fuels (provided later in this section) are from the United States Department of Energy, Energy Information Administration, Office of Coal, Nuclear, Electric, and Alternate Fuels. As such, statistics are unavailable for propane as a fuel for rural homes, for space and water heating, or for barbecues, and none are provided in this section.

Traditional Transportation Fuels (Fossil Fuels)

Fossil fuels are energy resources that come from the remains of plants and animals that are millions of years old. There are three fossil fuels: petroleum oil, natural gas, and coal. These fossil fuels provide the energy that powers our lifestyles and our economy, and are overwhelmingly responsible for fueling our transportation system. Our country's entire transportation infrastructure of pipelines and gas stations is built around fossil fuels. They are the foundation that we base our energy mix on, and they are a limited resource. Once these resources are depleted, they will no longer be part of our energy mix.

The main challenges with fossil fuels, in addition to their unsustainability, are related to their negative environmental impacts. The burning of fossil fuels is responsible for emissions that contribute to global climate change, acid rain, and ozone. As such, the development of alternatives to traditional transportation fuels is a priority.

Alternatives to Traditional Transportation Fuels

Alternatives to traditional transportation fuels are being developed and introduced into the consumer marketplace. Alternative fuels and vehicles currently in use in the United States are:

- Biodiesel and biogas
- Compressed natural gas (CNG)
- Liquefied natural gas (LNG)
- LPG/propane
- Ethanol, 85 percent (E85) (used in flexible fuel vehicles)
- Hydrogen and fuel cell vehicles
- Electric vehicles

The information in this section was prepared by the Energy Information Administration, the independent statistical and analytical agency within the United States Department of Energy.[1] Each year, the Energy Information Administration collects data on the number of alternative fuel vehicles supplied and, for a limited set of fleet user groups, the number of alternative fuel vehicles in use and the amount of alternative transportation fuel consumed. The user groups surveyed are the federal and State governments, alternative fuel providers, and transit companies.

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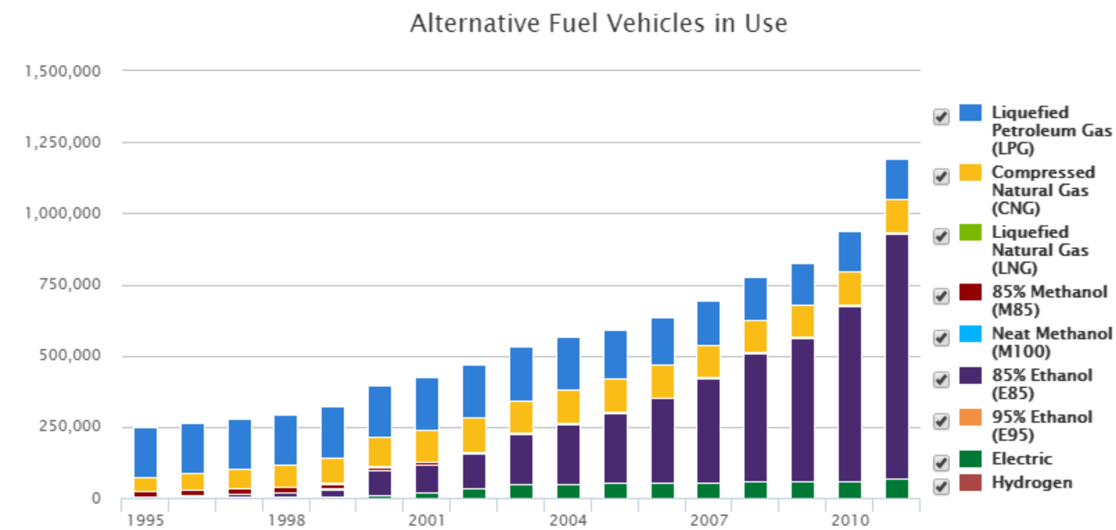
[1] Energy Information Administration. 2015. Website: http://www.eia.gov/state/?sid=CA (accessed August 4, 2015).

Alternative Fuel in Vehicle Use

The use of alternative fuel vehicles in the United States has steadily increased between 1995 and 2011, as shown on Figure 3.14.1. Overall, an estimated 1,191,786 alternative fuel vehicles were in use in the United States in 2011 (most recent data available). Total alternative fuel vehicle use in California increased from 136,409 in 2009 to 176,619 vehicles in 2011, which is 14.9 percent of all the alternative fuel vehicles in operation in the United States in 2011.



Source: Energy Information Administration's Alternative Fuel Vehicle Data

Notes: "E85 vehicles" includes only fleet-based vehicles and excludes vehicles with E85 fueling capability that are owned by individuals.

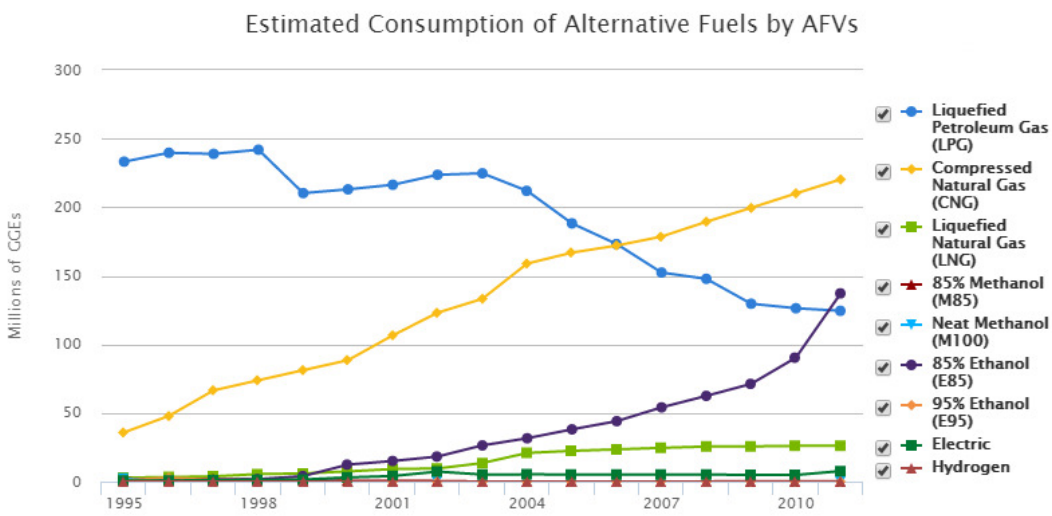
This chart shows the number of alternative fuel vehicles (AFVs) in use in the United States between 1995 and 2011. The number of AFVs in use has been increasing steadily during the past 15 years, largely due to federal policies that encourage and incentivize the manufacture, sale, and use of vehicles that use non-petroleum fuels. AFVs in widest use today are those that run on E85, propane, compressed natural gas, and electricity. The popularity of ethanol vehicles has grown widely since 1995 while the number of other alternative fueled vehicles has remained relatively constant.

Source: United States Department of Energy, *Alternative Fuels Data Center* (2014).

Figure 3.14.1 Alternative Fueled Vehicles in Use in the United States between 1995 and 2011

Alternative Fuel Consumption

Overall consumption of alternative transportation fuels in the United States increased almost 13 percent in 2011 to a total of 515,920,000 gasoline gallon equivalents (GGEs), compared to 457,755,000 GGEs in 2010. The estimated consumption of alternative fuels (in million GGEs) in the United States from 1995 through 2010 is shown on Figure 3.14.2.



Source: EIA's Alternative Fuel Vehicle Data

Notes: Fuel volumes are expressed in gasoline gallon-equivalents (GGEs), representing a volume of fuel with the same energy content as a gallon of gasoline.

This chart shows trends in alternative fuel consumption in alternative fuel vehicles, by fuel type, from 1995 to 2011. Compressed natural gas (CNG) consumption has increased steadily since 1995, owing largely to state and federal government incentives, increased natural gas supply, and falling natural gas prices. Use of propane, on the other hand, which was once the most common alternative vehicle fuel, has trended downward as CNG has become more popular. E85 use has been growing as the availability of flex fuel vehicles from major manufacturers has increased, and as an increasing number of fueling stations offer E85.

Source: United States Department of Energy, *Alternative Fuels Data Center* (2014).

Figure 3.14.2 Estimated Consumption of Alternative Fuel by Alternative Fuel Vehicles in the United States between 1995 and 2011

3.14.3 Environmental Consequences

The Build Alternative and the No Build Alternative were evaluated to determine if they would result in a demand for energy that would exceed the current supply, or cause a substantial increase in the rate of energy use. The analyses in this section are based on the Proposed Project's *Traffic Analysis Report* (July 2015).

3.14.3.1 Methodology

This energy analysis is based on the methodology described in detail in the Caltrans Standard Environmental Reference (SER), Volume 1, Chapter 13 – Energy (updated January 20, 2015). A quantitative energy analysis was conducted which discusses the direct and indirect energy conservation potential of the Build Alternative and the No Build Alternative. The Proposed Project would not be considered a "Major Project" requiring a more detailed energy analysis because the Proposed Project is not likely to have substantial impacts on energy consumption.

The energy analysis addresses two elements: direct and indirect energy consumption. Direct energy use is the energy consumed in the actual propulsion of a vehicle using the facility. It can be measured in terms of the thermal value of the fuel, the cost of the fuel, or the quantity of electricity used in the engine or motor. Direct energy use factors are:

- **Traffic-Related.** Year of study, volume of traffic, speed, distance, composition of vehicle types, characteristics of traffic flow, cold-start effects and idling; and.
- **Facility-Related.** Grades, curvature, pavement condition, stops (signs, signals, etc.) and altitude.

Indirect energy is defined as all the remaining energy consumed to run a transportation system, including construction energy, maintenance energy, and any substantial changes to energy consumption related to project-induced land use changes and mode shifts, and any substantial changes in energy associated with vehicle operation, manufacturing, or maintenance due to increased automobile use. Indirect energy use factors are:

- **Vehicle manufacture.** Materials and quantities, manufacture energy, useful life and salvage energy.
- **Vehicle maintenance.** Routine wear and replacement, road-related wear, operation of repair facilities, and fuel distribution.
- **Facility construction.** Excavation, backfill, dredging, structures, surface/pavements, signs, lights, heating, ventilation, and air conditioning (HVAC), landscaping, material transport, useful lives; or date/constant dollar cost, location, type of construction, useful lives.
- **Facility operation/maintenance.** Age of facility, equipment needed, and surface/pavement type and cost.
- **Peripheral effects.** Change in land use with time, change in fuel source with time, change in local energy need with time, future power plant sites, and location of energy-related natural resources.

Direct transportation energy consumption impacts were estimated for the Build Alternative and the No Build Alternative using traffic forecasts provided in the *Traffic Analysis Report* (July 2015), and the ARB EMFAC2014 air quality model, which provides estimated gasoline and diesel fuel consumption rates. The EMFAC2014 model assumptions include that the project location is in the South Coast Air Basin, with ambient temperatures at 50 degrees Fahrenheit (°F), and humidity at 50 percent.

Of the scenario years analyzed, estimated energy consumption in 2040 is expected to represent the most conservative (i.e., highest) energy consumption because population and employment are projected to be higher in that year than in any earlier year; therefore, energy consumption associated with the Proposed Project is calculated for 2040 in this impact analysis. In addition, this analysis does not reflect the benefit of energy efficiency and conservation measures that are likely to be adopted by 2040 and which would result in lower energy consumption than projected in these estimates (i.e., new California Environmental Protection Agency/United States Environmental Protection Agency fuel economy standards, bus rapid transit programs reducing personal vehicle use, and increased use of high-occupancy vehicles).

Project-related indirect energy impacts were estimated using standard Caltrans approximation factors as described in the SER. The analysis of these impacts is at the regional level and, therefore, by its nature, is a cumulative impacts analysis. Two main areas of potential impacts were identified: (1) energy demand for construction; and (2) energy demand for operation of the Proposed Project in 2040.

The indirect energy analysis for the Proposed Project was also conducted using the Caltrans Input-Output Method as described in the Caltrans *Energy and Transportation Systems Handbook* (July 1983). It was assumed that the energy requirements for manufacturing vehicles have not changed from those listed in the Handbook.

Because the Proposed Project is a transportation improvement, the Study Area for potential energy impacts is the *Traffic Analysis Report* (July 2015) Study Area, SR-91 from west of the Weir Canyon Road interchange in Anaheim Hills to east of the Serfas Club Drive/Auto Center Drive interchange in the City of Corona. The Study Area also includes SR-241 from north of the Santiago Canyon Road interchange to SR-91 and State Route 71 south of the Butterfield Ranch Road interchange to SR-91.

3.14.3.2 Temporary Impacts

Temporary indirect energy impacts result from the manufacture of vehicles that would operate on the project facilities and be used for project construction. Indirect manufacturing energy effects involve the one-time, nonrecoverable energy costs associated with the manufacture of vehicles. Construction energy impacts involve the one-time, nonrecoverable energy costs associated with construction of roads and structures. The Proposed Project would not, on its own, increase the manufacture of vehicles, therefore, the per-vehicle indirect energy impacts for the baseline (No Build), the Build Alternative, and the existing condition would all be the same.

Build Alternative (Two-Lane Express Lanes Connector) (Preferred Alternative)

The Build Alternative involves no planned use of natural resources beyond fuel and energy needed during construction and maintenance activities, including the materials needed for construction that require energy to produce and transport them to the project site.

As shown in Table 3.14.3, the estimated energy needed to construct the Build Alternative would be approximately 17 trillion BTUs. Table 3.14.3 shows that the Build Alternative would have a substantial increase to temporary indirect energy consumption in the Study Area compared to the No Build Alternative, approximately 660 percent. However, the energy expenditure to construct the Build Alternative would be off-set by the reduction in fuel consumption realized through more efficient freeway operations.

Table 3.14.3 Study Area Temporary Indirect Energy Impacts

Scenario	Construction-Related Energy				Total Temporary Indirect Energy (billion BTUs)	% Change from No Build
	Manufacturing		Energy to Build (billion BTUs)	Build Cost (millions)		
	Auto (billion BTUs)	Truck (billion BTUs)				
2040 Baseline (No Build Alternative)	2,490	139	–	–	2,629	–
2040 Build Alternative	2,530	140	17,300	$114	19,970	660%

Source: LSA Associates, Inc., based on data from the Caltrans *Energy and Transportation Systems Handbook* (July 1983) and the project *Traffic Analysis Report* (July 2015).
[1] Build cost in 2017 dollars, the earliest planned opening year.
BTUs = British thermal units

No Build Alternative

The No Build Alternative does not include any improvements to the interchange or local roads in the Project Area. Generally, construction energy can be compared to increased roadway maintenance energy if a project is not built. However, there is insufficient information to quantify this roadway maintenance energy. Therefore, the No Build Alternative would only result in temporary impacts related to energy from the manufacture of vehicles that operate on SR-241 and SR-91, which is included in Table 3.14.3.

3.14.3.3 Permanent Direct Impacts

Build Alternative (*Two-Lane Express Lanes Connector*) *(Preferred Alternative)*

Local energy demand for transportation projects typically is dominated by vehicle fuel usage. Energy calculations are based on the annual VMT; the annual VMT in the project Study Area in 2040 for the Build Alternative is shown in Table 3.14.4. In addition to VMT, traffic operating conditions in the Study Area also influence fuel consumption rates. Without the capacity improvements proposed in the Build Alternative, congested traffic conditions would be more prevalent throughout the Study Area. Those conditions would contribute to a higher energy consumption rate because vehicles use extra fuel while idling in stop-and-go traffic or moving at slow speeds on congested roads.

Table 3.14.4 Operational Annual Vehicle Miles Traveled in the Study Area

Scenario	Study Area Annual VMT (millions)		Total Study Area Annual VMT (millions)
	Auto	Truck	
2040 Baseline (No Build Alternative)	1,779	90	1,869
2040 Build Alternative	1,808	91	1,899

Source: *Traffic Analysis Report* (July 2015).
VMT = vehicle miles traveled

Both VMT and travel speeds were used to estimate the vehicle fuel consumption for the Build Alternative in 2040. For the energy consumption calculations, the EMFAC2014 fuel use percentages for each vehicle category were used to determine total gasoline and diesel fuel usage rates. Table 3.14.5 summarizes the annual energy use for cars and trucks (in millions of gallons) for the Study Area with the Build Alternative in 2040. Table 3.14.5 converts these measures of energy consumption into BTUs to provide a uniform metric to represent energy consumption for the Build Alternative, which was compared against baseline conditions (No Build Alternative) for the Study Area. Table 3.14.5 shows that the reduced traffic congestion provided in the Build Alternative would result in a 3.2 percent reduction in direct energy use annually in 2040 compared to the No Build Alternative.

Table 3.14.5 Study Area Direct Energy Consumption – Annual

Scenario	Annual Study Area Energy Consumption			Percent Change from 2040 Baseline
	Gasoline (millions of gallons)	Diesel (millions of gallons)	Operational Energy (billions of BTUs)	
2040 Baseline (No Build Alternative)	35	8.6	5,100	-
2040 Build Alternative	33	8.5	4,900	-3.2%

Source: LSA Associates, Inc., based on data from *Traffic Analysis Report* (July 2015) and California Air Resources Board EMFAC2014.
Note: Assumes an energy content of 130,500 BTUs per gallon of diesel fuel and 115,000 BTUs per gallon of gasoline.
Average speed in 2040 for the No Build Alternative is 39.6 mph and for the Build Alternative is 42.4 mph.
BTUs = British thermal units
mph = miles per hour

Although the vehicle mix operating in the Study Area roads would include increasing numbers of electric passenger and alternative fuel use vehicles, those vehicles use similar amounts of energy as gasoline powered vehicles per mile. Therefore, shifts to non-gasoline powered vehicles would not result in a large change in the energy use results shown in Table 3.14.5.

Local energy demand for transportation projects is typically dominated by vehicle fuel usage. For projects similar to the Proposed Project, it is assumed that the energy consumption by vehicles is much larger than the small change in other direct energy consumption, such as electrical energy consumption. The existing SR-241/SR-91 interchange has electrical demands from the operation of road and sign lighting. It is not expected that implementation of the Build Alternative would substantially change these current energy demands on the SR-241/SR-91 interchange.

2017 Conditions (Opening Year)[1]

The Build Alternative in the 2017 AM peak period would result in a slight increase in demand in the Study Area, resulting in a higher VMT; however, the overall efficiency of the westbound system in the AM peak period would increase under the Build Alternative. The total vehicle hours travelled (VHT) in the AM peak period would decrease by 2,056 hours, average speeds would increase by 5.8 miles per hour, and average delay would decrease by 1.9 minutes per vehicle.

The Build Alternative in the 2017 PM peak period would result in a slight increase in demand in the Study Area, also resulting in a higher VMT. These increases would

[1] The revised planned opening year is 2020. The difference in traffic operations between 2017 and 2020 in the Project Area would be nominal in the peak hours.

result in an overall decrease in efficiency of the 2017 eastbound system in the PM peak period with implementation of the Build Alternative. The increase in both travel times on certain segments during the peak period and total vehicle demand in the area would result in an increase of 1,330 total VHT, a nominal decrease in average speeds by 1.0 mile per hour, and a nominal increase in travel time of 0.4 minute per vehicle.

With implementation of the Build Alternative in 2017, the net total change in VHT would decrease by 726 VHT, indicating a slight increase in efficiency compared to the No Build Alternative because of the hours of vehicle use. Therefore, vehicle fuel/energy consumption would be reduced.

2040 Conditions (*Design Year*)

The Build Alternative in the 2040 AM peak period would increase demand in the Study Area, and VMT would increase from 2017 Build Conditions; however, the transportation system in the Study Area would be continue to be more efficient. That is, in the 2040 AM peak period, the total VHT would decrease by 2,422 hours, with the Build Alternative compared to the No Build Alternative.

The Build Alternative in the 2040 PM peak period would increase demand, and VMT would increase from 2017 Build Conditions; however, the transportation system in the Study Area would continue to be more efficient. In 2040, the total VHT would decrease by 586 hours with the Build Alternative compared to the No Build Alternative.

The Build Alternative would improve the overall efficiency of the Study Area freeways when compared to the future No Build Alternative, reducing the total VHT while also increasing the capacity in the Study Area. This overall reduction in the VHT and increase in system efficiency would result in less energy use than the No Build Alternative in 2040.

No Build Alternative

As presented in the traffic analysis, the No Build Alternative in 2017 and 2040 would result in forecasted increases in traffic volumes that would result in further worsening of traffic congestion and slower vehicle speeds in the Study Area. As discussed above, VHT in 2017 and 2040 will increase with the No Build Alternative, which will increase energy consumption when compared to the Build Alternative.

3.14.3.4 Permanent Indirect Impacts

Permanent indirect energy impacts consist principally of the ongoing, nonrecoverable energy costs associated with the maintenance of vehicles. This analysis was conducted using the Caltrans Input-Output Method. That method converts VMT based on existing data from other road improvement projects in the United States using conversions listed in the Caltrans *Energy and Transportation Systems Handbook*. It was assumed that the energy requirements for maintaining vehicles have not changed from those listed in the handbook. Thus, the per-vehicle indirect energy impacts for the Build Alternative and the No Build Alternative would be the same.

Build Alternative (Two-Lane Express Lanes Connector) (Preferred Alternative)

Using the annual VMT data for autos and trucks shown in Table 3.14.4, Table 3.14.6 shows maintenance-related energy consumption in the Study Area. As shown in Table 3.14.6, the Build Alternative would result in a 1.5 percent increase in maintenance-related permanent indirect energy consumption in 2040.

Table 3.14.6 Study Area Permanent Indirect Energy Impacts

Scenario	Maintenance-Related Energy			% Change from No Build
	Auto (billion BTUs)	Truck (billion BTUs)	Total (billion BTUs)	
2040 Baseline (No Build Alternative)	2,010	259	2,269	-
2040 Build Alternative	2,040	262	2,302	1.5%

Source: LSA Associates, Inc., using data from the *Traffic Analysis Report* (July 2015) and the Caltrans *Energy and Transportation Systems Handbook* (July 1983).
BTUs = British thermal units

No Build Alternative

Under the No Build Alternative, the existing permanent indirect energy consumption associated with the maintenance of vehicles operating on the facility would continue to occur in 2040.

3.14.4 Total Energy Impacts

The combination of the direct and indirect energy impacts of the Build Alternative and the No Build Alternative are summarized in Table 3.14.7. An important criterion in any energy impact analysis is if or when the energy savings a project achieves would offset the energy cost to construct the Proposed Project. If the energy savings would offset the energy costs, the Proposed Project would have a payback period (the period of time that it would take for the savings to exceed the costs). As is shown in Table 3.14.7, there are only very small non-construction energy direct and no indirect energy savings associated with the Build Alternative compared to the No Build Alternative, so the payback period for the Build Alternative is very large.

Table 3.14.7 Study Area Energy Consumption Summary

Scenario	Non-Construction Energy			Construction Energy (BBTUs/yr)	Total Energy (BBTUs/yr)	% Total Change from No Build
	Direct Energy (BBTUs/yr)	Indirect Energy (BBTUs/yr)	% Change from No Build			
2040 Baseline (No Build Alternative)	5,100	4,640	_	-	12,240	--
2040 Build Alternative	4,900	4,710	-0.92	17,300	26,960	180%

Source: LSA Associates, Inc., using data from the *Traffic Analysis Report* (July 2015) and the Caltrans *Energy and Transportation Systems Handbook* (July 1983).

[1] A payback period of fewer than 5 years is considered an excellent investment, while a payback period of greater than 20 years will generally be beyond the foreseeable future of the Proposed Project (Caltrans 1983).

BBTUs/yr = billion British thermal units per year

As shown in Table 3.14.7, the temporary indirect energy impacts of constructing the Build Alternative would be substantial. However, as shown in Table 3.14.7, the Build Alternative would not consume substantially more total energy than the No Build Alternative. Thus, while the Build Alternative would not have a quantifiable payback period from energy savings, the Build Alternative energy use and subsequent impact to regional energy supplies would not be substantial. Because the non-construction energy increase as a result of the Build Alternative is minimal when compared to the No Build Alternative, regional energy resources and utilities (electricity/vehicle fuels) would not be adversely impacted by the maintenance or operation energy demands of the Build Alternative. Therefore, no avoidance, minimization, or mitigation measures would be required.

3.14.5 Avoidance, Minimization, and/or Mitigation Measures

The Build Alternative would not result in adverse impacts related to energy consumption in the Study Area or region compared to the No Build Alternative. No avoidance, minimization, or mitigation measures are required.

3.14.6 Consistency with Energy Conservation Plans

The CEC, the California Public Utilities Commission (CPUC), and the City Planning Area (CPA) approved the final State of California Energy Action Plan in 2003. The Plan established shared goals and specific actions to ensure that adequate, reliable, and reasonably priced electrical power and natural gas supplies are achieved and provided through policies, strategies, and actions that are cost effective and environmentally sound for California's consumers and taxpayers. In 2005, an updated Energy Action Plan was adopted by the CEC and the CPUC to reflect policy changes and actions after 2003.

The State's energy policies have been substantially influenced by the passage of Assembly Bill (AB) 32, the California Global Warming Solutions Act of 2006. The CEC's Integrated Energy Policy Report (IEPR) advances policies that would enable the State to meet its energy needs in a carbon-constrained world. That report also provides a comprehensive set of recommended actions to achieve these policies.

Rather than produce a new Energy Action Plan, the CEC and the CPUC have prepared instead the Energy Action Plan – 2008 Update, which examines the State's ongoing actions in the context of global climate change. The update was prepared using the information and analysis prepared for the 2007 IEPR as well as recent CPUC decisions.

As described in Section 3.14.3, while the temporary indirect energy impacts of constructing the Build Alternative are substantial at a local level, the total indirect energy impacts would be negligible at the regional level. Because the California energy conservation planning actions are conducted at a regional level and, as described in Section 3.14.4, the total project impact to regional energy supplies would be minor, the Build Alternative would not conflict with these California energy conservation plans.

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